

## CLAIMS

- 1    1. An integrated circuit processor comprising:
  - 2       a first instruction buffer corresponding to a primary thread;
  - 3       a second instruction buffer corresponding to a backup thread;
  - 4       a thread switch mechanism that detects when the primary thread stalls, and in
  - 5       response thereto, swaps information stored in the first instruction buffer with information
  - 6       stored in the second instruction buffer.
  
- 1    2. The integrated circuit processor of claim 1 wherein execution of the backup thread  
2       occurs after the swap by executing at least one instruction in the first instruction buffer.
  
- 1    3. The integrated circuit processor of claim 1 further comprising:
  - 2       a third instruction buffer corresponding to a second primary thread;
  - 3       a fourth instruction buffer corresponding to a second backup thread;
  - 4       wherein the thread swap mechanism further detects when the second primary
  - 5       thread stalls, and in response thereto, swaps information stored in the third instruction
  - 6       buffer with information stored in the fourth instruction buffer.
  
- 1    4. The integrated circuit processor of claim 3 wherein the first and second primary  
2       threads simultaneously issue instructions for execution.

- 1    5.    An integrated circuit processor comprising:
  - 2       a first primary instruction buffer corresponding to a first primary thread;
  - 3       a second primary instruction buffer corresponding to a second primary thread;
  - 4       wherein the first and second primary threads simultaneously issue instructions for
  - 5       execution;
    - 6           a first backup instruction buffer;
    - 7           a second backup instruction buffer;
    - 8           a thread switch mechanism that detects when one of the first and second threads
    - 9       stalls, and in response thereto, swaps information stored in one of the first and second
    - 10      primary instruction buffers corresponding to the stalled thread with information stored in
    - 11      one of the first and second backup instruction buffers.
- 1    6.    The integrated circuit processor of claim 5 wherein the thread switch mechanism:
  - 2       (1) detects when the first primary thread stalls, and in response thereto,
  - 3       swaps the first primary instruction buffer with the first backup instruction buffer;
  - 4       and
  - 5       (2) detects when the second thread stalls, and in response thereto, swaps
  - 6       the second primary instruction buffer with the second backup instruction buffer.
- 1    7.    The integrated circuit processor of claim 5 wherein the first and second backup  
2       instruction buffers are part of a pool of backup instruction buffers, wherein information in  
3       any backup instruction buffer in the pool may be swapped with information in the first  
4       primary instruction buffer, and wherein information in any backup instruction buffer in the  
5       pool may be swapped with information in the second primary instruction buffer.

1       8.     An integrated circuit processor comprising:  
2              a first primary instruction buffer corresponding to a first primary thread;  
3              a second primary instruction buffer corresponding to a second primary thread;  
4              wherein the first and second primary threads simultaneously issue instructions for  
5     execution;  
6              a first backup instruction buffer;  
7              a second backup instruction buffer;  
8              a thread switch mechanism that detects when the first thread stalls, and in response  
9     thereto, begins issuing from the first backup instruction buffer, and that detects when the  
10   second thread stalls, and in response thereto, begins issuing from the second backup  
11   instruction buffer.

1       9.     A method for switching between a first thread of execution and a second thread of  
2     execution in a multithreaded processor, the method comprising the steps of:

- 3           (A) providing a first instruction buffer corresponding to the first thread;  
4           (B) providing a second instruction buffer corresponding to the second thread;  
5           (C) swapping information stored in the first instruction buffer with information  
6     stored in the second instruction buffer.

1       10.    The method of claim 9 wherein step (C) is performed when switching between the  
2     first thread and the second thread is required.

1       11.    The method of claim 9 wherein step (C) is performed when the first thread stalls.

1       12.    The method of claim 9 wherein step (C) is performed when the second thread  
2     stalls.

1       13.    The method of claim 9 further comprising the step of executing the second thread  
2     after the swapping of information in step (C) by executing at least one instruction in the  
3     first instruction buffer.

1       14.    The method of claim 9 further comprising the steps of:  
2           (D) providing a third instruction buffer corresponding to a third thread;  
3           (E) providing a fourth instruction buffer corresponding to a fourth thread; and  
4           (F) swapping information stored in the third instruction buffer with information  
5     stored in the fourth instruction buffer.

1       15.    The method of claim 14 wherein step (F) is performed when the third thread stalls.

1       16.     The method of claim 14 wherein step (F) is performed when the fourth thread  
2     stalls.

1       17.     The method of claim 14 wherein the first and third threads simultaneously issue  
2     instructions for execution.

1       18.     A method for switching between first and second threads of execution in a  
2     multithreaded processor, the method comprising the steps of:  
3               (A) providing a first primary instruction buffer corresponding to the first thread;  
4               (B) providing a second primary instruction buffer corresponding to the second  
5     thread;  
6               (C) providing a first backup instruction buffer corresponding to a first backup  
7     thread;  
8               (D) providing a second backup instruction buffer corresponding to a second  
9     backup thread;  
10              (E) simultaneously issuing instructions from the first primary instruction buffer and  
11     from the second primary instruction buffer; and  
12              (F) detecting when one of the first and second primary threads stalls, and in  
13     response thereto, swapping information stored in one of the first and second primary  
14     instruction buffers corresponding to the stalled thread with information stored in one of  
15     the first and second backup instruction buffers.

1       19.     The method of claim 18 wherein step (E) comprises the steps of:  
2              (1) detecting when the first primary thread stalls, and in response thereto,  
3     swapping information stored in the first primary instruction buffer with information  
4     stored in the first backup instruction buffer; and  
5              (2) detecting when the second thread stalls, and in response thereto,  
6     swapping information stored in the second primary instruction buffer with  
7     information stored in the second backup instruction buffer.

1    20.    The method of claim 18 wherein the first and second backup instruction buffers are  
2    part of a pool of backup instruction buffers, wherein information in any backup instruction  
3    buffer in the pool may be swapped with information in the first primary instruction buffer,  
4    and wherein information in any backup instruction buffer in the pool may be swapped with  
5    information in the second primary instruction buffer.

1        21.     A method for switching between threads of execution in a multithreaded  
2 processor, the method comprising the steps of:  
3                (A) providing a first primary instruction buffer corresponding to the first thread;  
4                (B) providing a second primary instruction buffer corresponding to the second  
5 thread;  
6                (C) providing a first backup instruction buffer corresponding to a first backup  
7 thread;  
8                (D) providing a second backup instruction buffer corresponding to a second  
9 backup thread;  
10              (E) simultaneously issuing instructions from the first primary instruction buffer and  
11 from the second primary instruction buffer; and  
12              (F) detecting when the first thread stalls, and in response thereto, issuing from the  
13 first backup instruction buffer instead of issuing from the first primary instruction buffer.

1        22.     The method of claim 21 further comprising the step of  
2              (G) detecting when the second thread stalls, and in response thereto, issuing from  
3 the second backup instruction buffer instead of issuing from the second primary  
4 instruction buffer.

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